

CLAIMS

What is claimed is:

1. An orthopedic fastening system for one tissue to another tissue, the system comprising:

5 a first elongate fastener that is affixable at a one end thereof down-hole a bore present within a first tissue, the elongate fastener having and presenting when so affixed an extension region that extends beyond the bore;

10 a split collet sliding along the fastener region that extends beyond the bore so as to force a second tissue that has been slipped over the fastener's extension region along this region and into position against the first tissue;

15 a sleeve forcibly sliding over the split collet in its position upon the fastener's extension region so as to contract the split collet against the fastener, thereafter locking the split collet into position holding tight the second tissue against the first tissue at the position of the bore.

2. The orthopedic fastening system according to claim 1 wherein the first elongate fastener comprises:

a shaft;

wherein the fastener region that extends beyond the bore is a length of the shaft.

3. The orthopedic fastening system according to claim 2

wherein the shaft has and presents a ramp surface in a region that extends within the bore;

and wherein the first elongate fastener further comprises:

25 an apertured split collet having (i) a central aperture fitting snugly around the shaft in the region thereof that extends within the bore, and (ii) flukes, the split collet having and presenting a first diameter less than the diameter of the bore until the shaft is forcibly moved transversely in the aperture of the split collet so as to force the collet's flukes to splay outward in greater separation from the central shaft, causing the flukes to expand in
30 diameter and to forcibly compress against the first tissue that surrounds the bore.

4. The orthopedic fastening system according to claim 2
wherein the shaft has and presents a ramp surface in a region that extends within
the bore;

5 and wherein the first elongate fastener further comprises:

an apertured split collet having (i) a central aperture fitting snugly around the shaft
in the region thereof that extends within the bore, and (ii) flukes, the split collet having
and presenting a first diameter less than the diameter of the bore until the shaft is forcibly
moved transversely in the aperture of the split collet so as to force the collet's flukes to
10 splay outward in greater separation from the central shaft, causing the flukes to expand in
diameter and to forcibly compress against the first tissue that surrounds the bore.

5. The orthopedic fastening system according to claim 4

wherein the flukes of the split collet splay outward so that their tips are towards
15 the entrance to the bore;

wherein the collet with its splayed flukes strongly resists extraction from the bore
by pulling.

6. The orthopedic fastening system according to claim 2 wherein the shaft, in its
20 extension region, comprises:

circumferential engagement features;

wherein the split collet engages the shaft's engagement features when contracted
on and round about the shaft by action of the sleeve.

25 7. The orthopedic fastening system according to claim 6 wherein the shaft's
circumferential engagement features comprise:

threads;

wherein the split collet screws upon the threads of the shaft when contracted on
and round about the shaft by action of the sleeve.

8. The orthopedic fastening system according to claim 6 wherein the shaft's circumferential engagement features comprise:

rachet pawls;

wherein the split collet locks upon the rachet pawls of the shaft when contracted on and round about the shaft by action of the sleeve.

9. The orthopedic fastening system according to claim 1

wherein the first elongate fastener is suitably sized and shaped so as to be affixable at a one end thereof down-hole a bore present within bone; and

wherein the second split collet is suitably sized and shaped, in its sliding along the fastener region that extends beyond the bore, so as to force a soft tissue that has been slipped over the fastener's extension region along this region and into position against the bone.

10. An orthopedic fastener for fastening a first tissue in which is present a bore to a second tissue in which is present a hole, the fastener comprising:

a shaft having and defining from a first end to a second end (i) a first circumferential surface region, (ii) a second circumferential surface region, and (iii) a circumferential region with engagement features;

a first split collet initially encircling the shaft at its second circumferential surface region;

a deployment sleeve temporarily fitting over the shaft to force the first split collet from the second to the first circumferential surface region of the shaft while the first end of the shaft remains inserted in the bore within the first tissue, the split collet expanding during sliding from the second to the first circumferential surface region so as to become affixed within the bore;

a second split collet for sliding along the shaft from the second end towards the first end that is affixed within the bore so that the second tissue that has its hole slipped over the shaft is forced along the shaft and into position against the first tissue;

a sleeve forcibly sliding over the second split collet in its position upon the shaft so as to contract the second split collet to the shaft, locking the second split collet into position holding tight the second tissue against the first tissue at the position of the bore;

wherein the first split collet expands while the second split collet contracts in order that each performs a holding function.

11. An orthopedic fastener comprising:

an elongate shaft having and defining circumferential engagement features, the shaft mountable at a one end region thereof to a first tissue of the body so that a remaining portion of the shaft with its circumferential engagement features extends beyond this first tissue;

a split collet having and defining (i) an interior bore of a larger diameter than is the shaft with its circumferential engagement features, by which bore the split collet may slip the extending portion of the shaft, (ii) a plurality of deformable flukes at a split end of the collet, (iii) engagement features, complimentary to the engagement features of the shaft, located internally circumferentially on the collet's plurality of flukes, and (iv) a ramp surface located externally circumferentially on the collet's plurality of flukes; and

a sleeve in the shape of a hollow truncated frustaconical body, the sleeve having and defining an internal bore of larger diameter than is an external diameter of the split collet elsewhere from the collet's plurality of flukes, and also an internally circumferential ramp surface to the bore which ramp surface is complimentary in shape and in diameter to the ramp surface of the collet's plurality of flukes;

wherein when the split collet is slid upon the extended portion of the elongate shaft, and then the sleeve is slid forcibly over the split collet until its interior ramp surface forcibly engages the exterior ramp surface of the collet's plurality of flukes, then the plurality of flukes are deformed until their internal circumferential engagement features engage the complimentary engagement features of the extended shaft portion, affixing the split collet to the shaft.

12. The fastener according to claim 11 wherein the elongate shaft's circumferential engagement features comprise:

threads;

and wherein the engagement features located internally circumferentially on the collet's plurality of flukes comprise:

threads;

wherein the split collet is affixable for threading the shaft.

13. The fastener according to claim 11 wherein the elongate shaft's circumferential engagement features comprise:

friction surface;

and wherein the engagement features located internally circumferentially on the collet's plurality of flukes comprise:

radial phalanges;

wherein the split collet is affixable to the shaft by compression of its phalanges against the shaft.

14. The orthopedic fastening system according to claim 11 wherein the shaft's circumferential engagement features comprise:

ratchet pawls;

wherein the split collet locks upon the ratchet pawls of the shaft when contracted on and round about the shaft by action of the sleeve.

15. The fastener according to claim 11

wherein the split collet further has and defines an exterior circumferential engagement feature;

wherein the sleeve further has and defines an interior circumferential engagement feature complimentary to the engagement feature of the collet; and

wherein when the sleeve is slid forcibly over the split collet then, by engagement of the complimentary engagement features of collet and of sleeve, the sleeve becomes engaged to the collet concurrently that the collet becomes affixed to the shaft.

5 16. An orthopedic fastening system for one tissue to another tissue, the system comprising:

10 a first elongate fastener that extends through a bore present within a first tissue, the elongate fastener having and presenting when so extending (i) a first extension region extending beyond the bore at a one side of the first tissue, which first extension region has and defines an aperture through which aperture first suture is passed to engage the elongate fastener to the first tissue, and (ii) a second extension region oppositely extending beyond the bore at an opposite side of the first tissue;

15 a split collet sliding along the fastener's second extension region that extends beyond the bore so as to force a second tissue that has been slipped over the fastener's extension region along this region and into position against the first tissue;

20 a sleeve forcibly sliding over the split collet in its position upon the fastener's second extension region so as to contract the split collet against the fastener, thereafter locking the split collet into position holding tight the second tissue against the first tissue at the position of the bore.

25 17. The orthopedic fastening system according to claim 16 wherein the elongate fastener's second extension region comprises:

a shaft having circumferential engagement features;
wherein the split collet engages the shaft's engagement features when contracted on and round about the shaft by action of the sleeve.

18. The orthopedic fastening system according to claim 16 wherein the elongate fastener's second extension region comprises:

30 a length of second suture threading and held to a body of the fastener that is within the bore;

wherein the split collet compressively engages and holds the length of second suture when contracted on and round about the length of second suture by action of the sleeve.

5 19. An orthopedic fastening system for one tissue to another tissue, the system comprising:

a first elongate fastener that extends through a bore present within a first tissue, the elongate fastener having and presenting when so extending (i) a first extension region extending beyond the bore at a one side of the first tissue, which first extension region has and defines an pivoting member which member passes though the bore and then pivots at the one side thereof so as to thereafter no longer pass though the bore, and (ii) a second extension region oppositely extending beyond the bore at an opposite side of the first tissue;

10 a split collet sliding along the fastener's second extension region that extends beyond the bore so as to force a second tissue that has been slipped over the fastener's extension region along this region and into position against the first tissue;

15 a sleeve forcibly sliding over the split collet in its position upon the fastener's second extension region so as to contract the split collet against the fastener, thereafter locking the split collet into position holding tight the second tissue against the first tissue at the position of the bore.

20 20. The orthopedic fastening system according to claim 19 wherein the elongate fastener's second extension region comprises:

a shaft having circumferential engagement features;

25 wherein the split collet engages the shaft's engagement features when contracted on and round about the shaft by action of the sleeve.

21. The orthopedic fastening system according to claim 19 wherein the elongate fastener's second extension region comprises:

a length of suture anchored to the pivoting region an/d passing at least a part of the bore;

wherein the split collet compressively engages and holds the length of suture when contracted on and round about suture by action of the sleeve.

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22. The orthopedic fastening system according to claim 20 wherein the elongate shaft's second extension region circumferential engagement features comprise:

threads;

and wherein the collet further comprises:

10 threads located internally circumferentially on the plurality of flukes;

wherein the split collet is affixable for threading the shaft.

23. The orthopedic fastening system according to claim 20 wherein the elongate shaft's second extension region circumferential engagement features comprise:

15 a friction surface;

and wherein the collet further comprises:

radial phalanges located internally circumferentially on the collet's plurality of flukes;/

20 wherein the split collet is affixable to the shaft by compression of its phalanges against the shaft.

24. The orthopedic fastening system according to claim 20 wherein the shaft's circumferential engagement features comprise:

ratchet pawls;

25 wherein the split collet locks upon the ratchet pawls of the shaft when contracted on and round about the shaft by action of the sleeve.

25. A method of variably selectively compressing in vivo a free end of a soft tissue comprising:

engaging in vivo the free end of the soft tissue (i) about an elongate fastener that is affixed at a one end thereof down-hole a bore present within another, second tissue, the elongate fastener having and presenting when so affixed an extension region that extends beyond the bore, and (ii) between, on the one hand, a sliding lock means that both slides
5 along the fastener region that extends beyond the bore, and that locks and unlocks in its position upon the fastener's extension region, and, on the other hand, the second tissue;

first sliding in vivo the sliding lock means in a selectable first position along the fastener region that extends beyond the bore so as to compress to a first variably selectable extent said soft tissue, which soft tissue has been engaged about the fastener's
10 extension region and between the sliding lock means and the second tissue, into position against the first tissue; and

locking the sliding lock means in its selectable first position, therein to compress the soft tissue against the second tissue to a variably selectable first degree.

26. The method of variably selectively compressing in vivo a free end of a soft tissue according to claim 25 expanded and extended to variably selectively re-compressing in vivo the free end of the soft tissue, the expanded and extended method further comprising:

unlocking in vivo, at a time after the locking, the locked sliding lock means in its
20 first selectable position along the fastener region;

second sliding in vivo the sliding lock means along the fastener region that extends beyond the bore to a selectable second position so as to compress said soft tissue that has been engaged about the fastener's extension region into position against the first tissue to a second variably selectable degree that is different from the first variably
25 selectable degree; and

re-locking the sliding lock means at it's selectable second position, therein to re-compress the soft tissue against the second tissue to the variably selectable second degree.

27. The expanded and extended method according to claim 26 wherein the engaging in vivo comprises:

forming an aperture in the free end of the soft tissue; and
slipping the aperture of the free end of the soft tissue over an end of the elongate
fastener opposite to that end of the fastener that is affixed down-hole the bore.

5 28. The expanded and extended method according to claim 26
 wherein the engaging is of the free end of a tendon.

29. The expanded and extended method according to claim 26
 wherein the engaging is of the free end of a ligament.

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30. The expanded and extended method according to claim 26
 wherein the engaging is of the free end of a joint capsule.

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31. The expanded and extended method according to claim 26
 wherein the engaging is of the free end of the soft tissue about a first elongate
fastener that is affixed at a one end thereof down-hole a bore present within bone.

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32. A method of variably selectively tensioning in vivo a soft tissue to another,
second, tissue, the method comprising:

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engaging in vivo a soft tissue (i) about an elongate fastener that is affixed at a one
end thereof down-hole a bore present within another, second tissue, the elongate fastener
having and presenting when so affixed an extension region that extends beyond the bore,
and (ii) between, on the one hand, a sliding lock means that both slides along the fastener
region that extends beyond the bore, and that locks and unlocks in its position upon the
fastener's extension region, and, on the other hand, the second tissue;

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first sliding in vivo the sliding lock means in a selectable first position along the
fastener region that extends beyond the bore so as to tension to a first variably selectable
extent said soft tissue, which soft tissue has been engaged about the fastener's extension
region and between the sliding lock means and the second tissue, into position proximate
to the first tissue; and

locking the sliding lock means in its selectable first position, therein to tension the soft tissue towards the second tissue to a variably selectable first extent.

33. The method of variably selectively tensioning in vivo a free end of a soft tissue according to claim 32 expanded and extended to variably selectively re-tensioning in vivo the soft tissue, the expanded and extended method further comprising:

unlocking in vivo, at a time after the locking, the locked sliding lock means in its first selectable position along the fastener region;

second sliding in vivo the sliding lock means along the fastener region that extends beyond the bore to a selectable second position so as to tension said soft tissue that has been engaged about the fastener's extension region into position against the first tissue to a second variably selectable extent that is different from the first variably selectable extent; and

re-locking the sliding lock means at it's selectable second position, therein to re-tension the soft tissue towards the second tissue to a variably selectable second extent.